The Influence of Asphalt on Surrounding Short-Grass Surface Temperature

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PROBLEM

When my science teacher told our class that we have to come up with a science fair project I got to thinking. But I didn't know what to do! So I thought and thought. Then it hit me! I'm going to do something involved with worms. I decided to talk to my Globe teacher first. He asked me what I was going to do with the worms. I looked straight at him and said I really don't know. Then he told me to find a project I would enjoy and want to do.

So I thought again and again. The next day I still didn't have a project idea. Later that day I was sitting in the parking lot waiting for my mom's meeting to be over. Then I got hot and bored so I went to sit in the grass thinking of a project. It was so much cooler in the grass anyway. That night I knew exactly what I was going to do! I told my Globe teacher about what happened and how I realized the grass was cooler than the asphalt. We talked it over and came up with a project I really enjoyed. This is how I came up with my science fair project. Studying the Influence Asphalt has on Surrounding Short–Grass Surface Temperature.

HYPOTHESIS

My hypothesis is the farther away from the asphalt, the cooler the short-grass surface temperature will be. I also believe the opposite will be true: the closer to the asphalt, the warmer the short-grass surface temperature.

MATERIALS

1. Fluke 63 Infrared Thermometer (IRT).
2. www.globe.gov website.
3. Oven Mitt.
4. Clip Board.
5. Surface Temperature Data Sheet.

PROCEDURE

1. First I set up my study site by using spray paint (red) and sprayed three individual spots on the asphalt approximately three meters apart. Then I sprayed three spots in the short-grass also three meters apart.

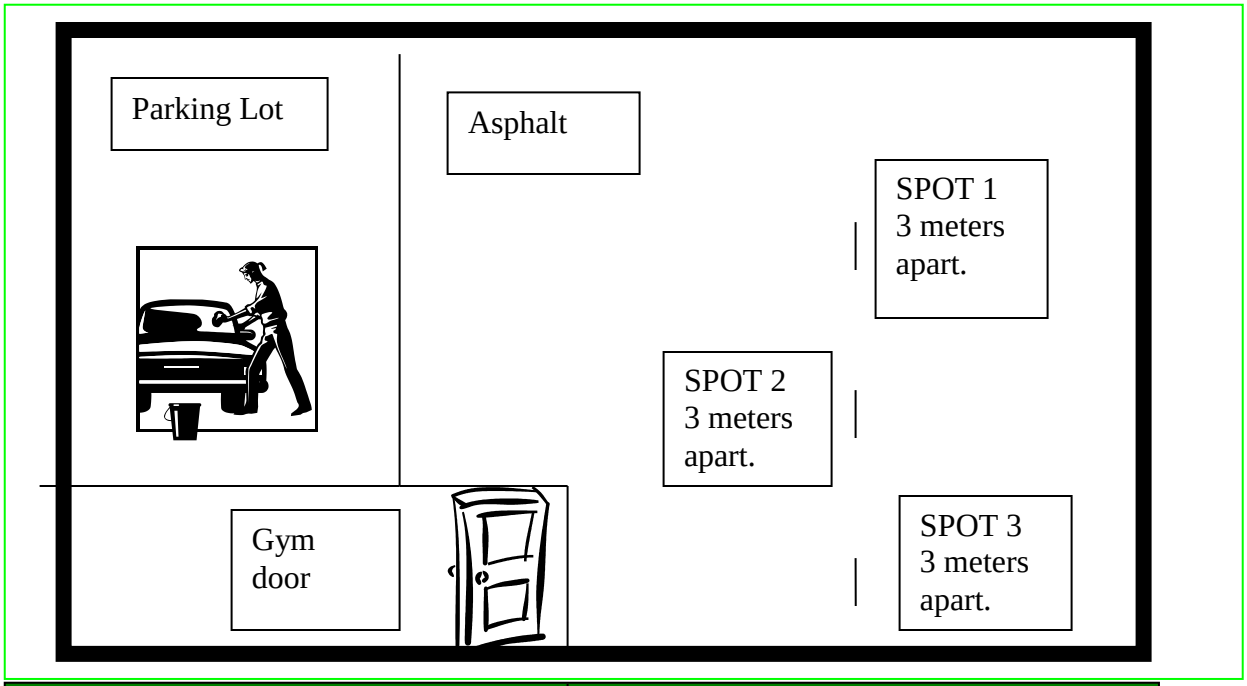
2. I go to the study sight.

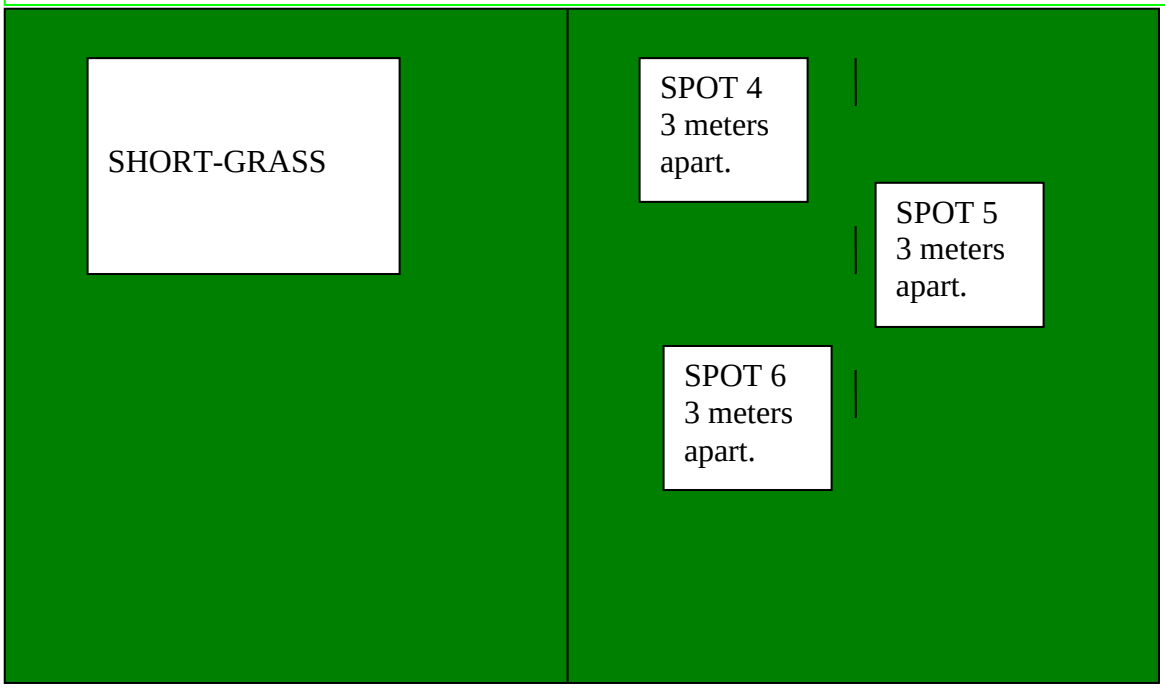
3. Hold the thermal glove so the thumb points down. Position the IRT in the finger section of the thermal glove with the sensing eye pointing out through the cut hole in the end of the finger section. Make sure the thermal glove does not cover the sensing eye and laser areas; however, also make sure that the IRT fits snugly against the front area of the thermal glove to prevent air from flowing through the glove. (Ignore the thumb section of the thermal glove)**.**

4. Position the digital display screen so that it is visible in the upper cut hole (when the thumb is pointing downward.)

5. Take your hand out of the thermal glove and use a rubber band to tighten the thermal glove around the IRT handle at the large bottom opening of the thermal glove. Operate the IRT from **outside** the thermal glove by placing your finger on the recording button and squeezing.

6. Then I write down my data, date, cloud coverage, and who collected the data.


Parking Lot
Asphalt
SPOT 1
3 meters
apart.
SPOT 2
3 meters
apart.
SPOT 3
3 meters
apart.
Gym
door


SHORT-GRASS
SPOT 4
3 meters
apart.
SPOT 5
3 meters
apart.
SPOT 6
3 meters
apart.

RESULTS

(All temperatures are in degrees Celsius)

Day One:

Spot One: 8.8, 8.4, 8.4, 9.6, 9.2, 7.8, 9.0, 9.4, and 8.6

Spot Two: 8.4, 9.6, 8.2, 9.2, 9.4, 9.2, 9.6, 7.4, and 7.4

Spot Three: 6.8, 7.0, 6.6, 6.6, 6.7, 8.2, 7.0, 7.2, and 7.6

Spot Four: 8.2, 6.8, 6.6, 8.2, 7.6, 8.4, 6.8, 7.4, and 8.2

Spot Five: 8.2, 7.2, 8.2, 7.2, 8.2, 8.4, 8.6, 6.8, and 7.4

Spot Six: 7.2, 6.8, 7.6, 6.6, 7.8, 8.2, 6.8, 7.6, and 8.4

Averages:

Spot One: 8.8

Spot Two: 8.7

Spot Three: 7.1

Spot Four: 7.6

Spot Five: 7.8

Spot Six: 7.4

Day Two:

Spot One: 8.2, 8.4, 8.4, 8.2, 8.6, 8.4, 7.8, 8.2, and 8.4

Spot Two: 7.0, 7.6, 7.8, 7.8, 7.6, 7.4, 7.0, 7.6, and 7.8

Spot Three: 7.2, 7.2, 7.8, 7.6, 6.7, 6.6, 6.8, 6.4, and 6.4

Spot Four: 7.4, 6.6, 6.4, 6.2, 7.0, 7.6, 7.4, 7.4, and 6.6

Spot Five: 7.4, 9.4, 6.4, 7.4, 7.0, 6.8, 7.2, 6.6, and 6.6

Spot Six: 5.4, 5.0, 5.6, 6.2, 5.4, 5.4, 5.8, 5.6, and 5.0

Averages:

Spot One: 8.3

Spot Two: 7.5

Spot Three: 7.0

Spot Four: 7.2

Spot Five: 7.2

Day Three:

Spot One: 8.8, 9.9, 10.2, 9.6, 9.6, 9.2, 9.2, 9.0, and 8.2

Spot Two: .5.2, 8.8, 9.4, 9.2, 9.4, 9.9, 8.8, 9.3, and 9.6

Spot Three: 7.2, 8.4, 9.4, 7.2, 6.8, 6.6, 6.4, 6.0, and 6.0

Spot Four: 7.8, 6.6, 8.2, 7.8, 7.6, 7.2, 6.2, 7.6, and 7.2

Spot Five: 10.6, 9.2, 8.6, 9.6, 8.4, 10.8, 9.3, and 8.2

Spot Six: 3.4, 4.2, 5.4, 4.6, 4.2, 6.0, 7.5, 3.5, and 7.2

Averages:

Spot One: 9.3

Spot Two: 8.8

Spot Three: 7.1

Spot Four: 7.4

Spot Five: 9.2

Spot Six: 5.1

Day Four:

Spot One: 7.0, 7.2, 7.4, 7.4, 8.6, 6.8, 6.8, and 8.4

Spot Two: 8.6, 6.6, 8.4, 8.0, 8.8, 6.2, 8.8, 6.0, and 6.0

Spot Three: 7.0, 6.8, 7.4, 7.8, 7.0, 6.5, 7.0, 6.8, and 7.8

Spot Four: 6.2, 8.8, 7.0, 7.8, 8.0, 6.2, 7.0, 8.4, and 8.6

Spot Five: 7.2, 8.2, 7.6, 7.4, 7.2, 7.6, 7.8, 7.6, and 6.4

Spot Six: 6.4, 5.6, 3.8, 4.8, 4.2, 4, 6, 4.6, 5.6, and 6.6

Averages:

Spot One: 6.6

Spot Two: 7.5

Spot Three: 7.1

Spot Four: 7.6

Spot Five: 7.4

Spot Six: 5.1

Day Five:

Spot One: 9.0, 9.8, 9.8, 10.2, 9.8, 9.6, 9.6, 9.8, and 10.8

Spot Two: 9.8, 10.6, 9.8, 10.2, 10.2, 9.8, 10.2, 10.6, and 10.8

Spot Three: 10.8, 10.4, 10.8, 9.6, 9.8, 9.8, 9.8, 9.6, and 7.6

Spot Four: 8.6, 8.6, 8.6, 8.6, 8.6, 8.2, 8.6, 8.6, 8.6, and 8.6

Spot Five: 8.2, 8.6, 9.4, 9.0, 9.8, 8.6, 8.6, 8.8, and 9.6

Spot Six: 3.0, 3.8, 3.4, 3.8, 3.6, 3.6, 3.2, 3.2, and 3.6

Averages:

Spot One: 9.8

Spot Two: 19.8

Spot Three: 9.8

Spot Four: 9.5

Spot Five: 8.9

Spot Six: 3.5

Day Six:

Spot One: 13.0, 15.0, 15.2, 15.2, 15.4, 15.2, 15.0, 14.8, and 14.8

Spot Two: 14.8, 14.8, 14.8, 14.8, 14.8, 14.6, 14.8, 15.2, and 14.6

Spot Three: 15.2, 15.4, 15.2, 15.4, 15.4, 15.4, 15.4, 15.4, and 15.4

Spot Four: 15.0, 15.4, 15.4, 15.4, 15.4, 15.8 15.4, 15.4, and 15.4

Spot Five: 15.6, 15.4, 15.6, 15.6, 15.4, 15.4, 15.6, 15.4, and 15.4

Spot Six: 15.2, 15.4, 15.2, 15.6, 15.0, 14.8, 15.0, 15.0, and 14.8

Averages:

Spot One: 14.8

Spot Two: 15.4

Spot Three: 15.4

Spot Four: 15.4

Spot Five: 15.5

Spot Six: 15.1

Day Seven:

Spot One: 11.4, 11.6, 11.8, 11.2, 10.8, 11.6, 11.6, and 11.8

Spot Two: 12.4, 9.2, 12.6, 9.4, 12.8, 12.8, 13.4, 12.2, and 12.4

Spot Three: 7.4, 9.6, 8.8, 7.6, 7.4, 7.6, 8.6, 7.6, and 7.4

Spot Four: 11.6, 13.2, 12.7, 11.4, 11.4, 13.2, 12.6, 13.2, and 13.8

Spot Five: 11.8, 11.6, 12.4, 13.0, 13.2, 12.6, 12.6, 12.2, and 13.2

Spot Six: 6.2, 6.4, 5.8, 10.2, 6.9, 6.4, 12.2, 6.6, and 11.5

Averages:

Spot One: 10.2

Spot Two: 11.9

Spot Three: 8.0

Spot Four: 12.8

Spot Five: 12.5

Spot Six: 8.0

Day Eight:

Spot One: 8.4, 8.2, 7.8, 8.4, 8.2, 8.0, 8.4, 8.8, and 2.4

Spot Two: 7.8, 8.4, 8.8, 7.2, 7.0, 6.0, 8.8, 8.8, and 6.4

Spot Three: 6.6, 6.6, 6.4, 5.8, 6.2, 9.2, 10.4, 6.4, and 6.6

Spot Four: 11.0, 13.6, 14.2, 15.6, 14.0, 15.6, 10.8, 8.4, and 10.0

Spot Five: 8.5, 8.8, 9.2, 9.6, 9.2, 9.6, 9.2, 10.0, 8.8, 9.4, and 9.2

Spot Six: 6.2, 5.6, 8.8, 8.8, 9.2, 5.4, 5.6, 5.8, and 5.8

Averages:

Spot One: 7.6

Spot Two: 7.6

Spot Three: 7.1

Spot Four: 12.4

Spot Five: 11.3

Spot Six: 6.8

Day Nine:

Spot One: 9.2, 9.2, 9.0, 8.8, 8.8, 9.0, 8.8, 6.8, and 9.2

Spot Two: 9.4, 9.0, 9.4, 14.8, 9.4, 12.6, 13.4, 9.9, and 9.9

Spot Three: 9.2, 9.2, 9.2, 9.2, 9.2, 9.6, 8.8, 9.2, and 9.2

Spot Four: 9.4, 9.2, 9.2, 9.2, 9.4, 9.2, 9.6, 9.6, and 9.4

Spot Five: 9.4, 9.2, 9.4, 9.4, 8.8, 9.2, 9.0, 9.2, and 9.0

Spot Six: 9.0, 9.0, 9.2, 8.8, 8.8, 8.6, 9.0, 9.8, and 8.8

Averages:

Spot One: 8.8

Spot Two: 10.8

Spot Three: 8.3

Spot Four: 9.4

Spot Five: 7.2

Spot Six: 9.0

Day Ten:

Spot One: 6.8, 7.2, 7.4, 7.0, 7.4, 7.6, 7.4, 6.8, and 6.8

Spot Two: 7.4, 7.6, 7.6, 7.4, 7.4, 7.8, 8.0, 7.4, 7.4, and 7.4

Spot Three: 7.4, 7.4, 7.6, 7.6, 8.0, 7.6, 7.4, 7.8, c and 7.4

Spot Four: 8.0, 7.2, 7.2, 8.7, 7.8, 7.4, 7.2, 6.6, and 7.4

Spot Five: 6.8, 7.2, 6.4, 6.2, 7.4, 7.0, 6.4, 6.8, and 7.6

Spot Six: 6.8, 6.8, 6.2, 5.2, 6.8, 7.4, 6.6, 6.0, and 7.6

Averages:

Spot One: 7.2

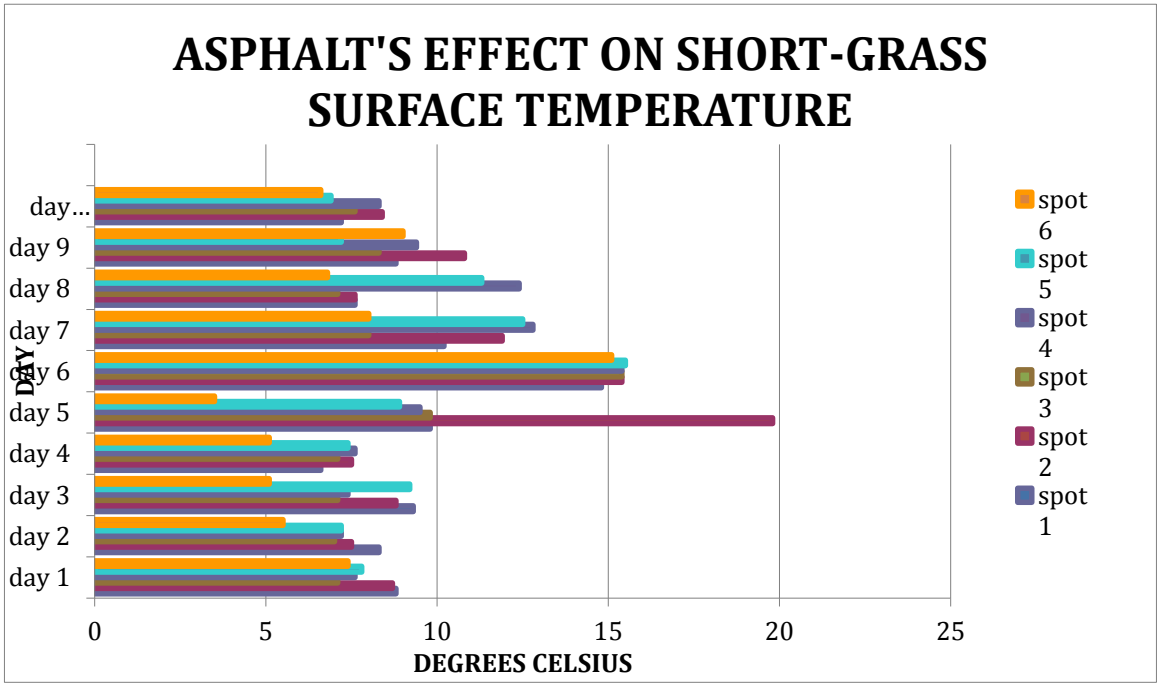
Spot Two: 8.4

Spot Three: 7.6

Spot Four: 8.3

Spot Five: 6.9

Spot Six: 6.6


ASPHALT'S EFFECT ON SHORT-GRASS SURFACE TEMPERATURE
day...
day 9
day 8
day 7
day 6
day 5
day 4
day 3
day 2
day 1
DAY
0
5
10
15
20
25
DEGREES CELSIUS
spot 6
spot 5
spot 4
spot 3
spot 2
spot 1

CONCLUSION

During the investigation my hypothesis was supported by the data collected. The farther away from the asphalt you get, the cooler the short-grass surface temperature will become. And the closer to the asphalt, the warmer it will become.

Some errors or problems I may have encountered during data collecting were the (IRT) Infrared Thermometer wasn't working one day. I replaced the IRT with another one. My friend who helped me collect data has Dyslexia, which makes words or letters jumbled when she sees them sometimes. This led to some interesting data told to me. A third problem was spot three is shadowed by a dumpster which makes the surface temperature much cooler. I considered this data as an outlier or false.

In the future I might make sure the Infrared thermometer is working all the time or use somebody else to help instead.

During this investigation along the way I learned the cloud coverage data changed. One example of this change was on sunny days the asphalt was warmer and on cloudy or rainy days the asphalt and short-grass were almost in the same surface temperature.

The problem of orange trees frosting at night came to my attention when my GLOBE Program teacher mentioned it before he went to Florida on Christmas break. So I thought what if my project could help prevent the frosting of orange trees. Since asphalt has a high albedo, which means it absorbs more heat energy from the sun, maybe a long strip of asphalt or black tarp could be laid below the orange trees to collect and store

the sun’s energy, radiating the heat out at night, making the orange trees unable to frost at night. This concludes my overall thought on this topic.

ABSTRACT

The problem of heat absorption on asphalt could be important for orange tree growers in Florida. The hypothesis is the farther away from asphalt the colder the short-grass becomes. If the asphalt would absorb enough of the sun's energy during the day it might be able to solve the problem with orange trees frosting at night.

First the project was set up with three spots on asphalt measured three meters apart, and three spots in the short-grass also measured three meters apart. Data was collected using an Infrared Thermometer on each spot nine times everyday for ten days. Next, the project consisted of six spots with nine surface temperatures each. It came out to a total of fifty-six surface temperatures everyday, multiplied by ten days equal 5,600 surface temperatures taken. Data was averaged in order to make this large data set more manageable. Finally, the data supported the hypothesis. The farther away from the asphalt, the cooler the surface temperature of short-grass becomes.

REFERENCES

Frantz, S. Science Teacher, Roswell Kent Middle School, (personal Communication, 2012 to 2013).

Globe. (2012-2013). Data retrieved December 7, 2012 to January 16, 2013 from www.globe.gov.

Google Earth. (2012 to 2013). Images retrieved during December 1st and January 4th 2013. http://www.earth.google.com

Jansen, J. Language Arts Teacher, Roswell Kent Middle School, (personal communication, 2012 to 2013).

Johnson. O.A. (2013). Grass. In World Book Student. retrieved data from http://www.Worldbookonline.com

NOAA. (2012). Data retrieved December 15th to January 6th from http:www.noaa.gov

Struble, J. and M. Headly. (2004, May). A community of learners. The Science of Teachers, 71(5), 46-47.

Shellito, B. (2012). Introduction to geospatial technologies. New York NY 10010. W.H. Freeman.

Whaley, D. Science Teacher, Roswell Kent Middle School, (personal communication, 2012 to 2013).